Public Abstract

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Title:Compact Power Conditioning and RF Systems for a High Power RF Source

As part of the University Consortium for High Power Microwave (HPM) Integration, compact power conditioning and RF systems were investigated. A simulator of a flux compression generator (FCG) was built as a non-destructive test stand to evaluate the compact systems. The FCG simulator approximated the rising current signal of an FCG. The power conditioning system consisted of a spiral-strip pulse transformer, an exploding wire fuse, and a crowbar switch. The pulse transformer enabled compact inductive energy storage, voltage step-up, and electrical isolation. The exploding wire fuse was implemented as an opening switch to transfer energy to the RF circuit. The crowbar switch prevented stray or generator inductance from causing fuse restrike. The RF system utilized a compact high voltage capacitor and low inductance shunt to produce high frequency RF. Three geometries of the RF system were investigated. A tri-plate system was built as a proof of principle, and spiral-strip and coaxial-cylinder geometries were investigated as compact designs.

Experimental testing of the power conditioning and RF systems was conducted with the FCG simulator and FCGs. Load voltages of 180 kV or more were generated with all three geometries, resulting in greater than 130 MW of peak power. The RF frequency content peaked at 10s of MHz, and the frequency content of the tri-plate geometry extended to 250 MHz. With an antenna load, the peak voltage was greater than 700 kV. An electric field of 6 kV/m peak-to-peak was measured 5.5 m from the system, thus achieving the goal of the consortium.